AMENDMENTS TO THE CLAIMS

This listing of claims replaces all prior listing of claims in this application.

1. (Original) A control method of a permanent-magnet type synchronous motor provided with a frequency arithmetic unit of alternating current fed to the motor so that axial displacement is reduced based upon the axial displacement of the permanent-magnet type synchronous motor and a power converter that feeds alternating current of a variable frequency and variable voltage to the motor according to d-axis and q-axis output voltage directions based upon its frequency direction and a rotational phase direction, comprising:

a first step for operating axial displacement which is difference between the rotational phase direction and an actual rotational phase of the motor using a frequency or current information acquired from a control system as a first axial displacement signal;

a second step for estimating axial displacement caused in the motor by a control response angular frequency in the frequency arithmetic unit as a second axial displacement signal; and

a third step for inputting a third axial displacement signal acquired by adding the first and second axial displacement signals to the frequency arithmetic unit.

2. (Currently amended) A control method of a permanent-magnet type synchronous motor provided with a frequency arithmetic unit that creates a frequency direction of alternating current fed to the motor based upon the axial displacement of the permanent-magnet type synchronous motor and a power converter that feeds

alternating current of a variable frequency and variable voltage to the motor based upon the frequency direction, comprising:

a first step for operating axial displacement which is difference between a rotational phase direction and an actual rotational phase of the motor using information acquired from a control system as a first axial displacement signal;

a second step for estimating axial displacement caused in the motor in relation to the frequency arithmetic unit as a second axial displacement signal; and

a third step for inputting a third axial displacement signal acquired by ~~tinging~~ adding the first and second axial displacement signals to the frequency arithmetic unit.

3. (Original) A control method of a permanent-magnet type synchronous motor according to Claim 2, wherein:

the second step includes a step for inputting information related to a frequency or current acquired from a control system and estimating the second axial displacement signal using a control constant of the frequency arithmetic unit.

4. (Original) A control method of a permanent-magnet type synchronous motor according to Claim 2, wherein:

the second step includes a step for differentiating a velocity frequency or a frequency direction acquired based upon a polar position sensed value of the motor, multiplying by a factor of proportionality, executing a first-order lag process and estimating the second axial displacement signal.

5. (Original) A control method of a permanent-magnet type synchronous motor according to Claim 2, wherein:

the second step includes a step for inputting a current value or its directed value of a q-axis (equivalent to a torque axis) of a rotatory coordinate system calculated based upon a sensed value of current flowing in the motor and the rotational phase direction and estimating the second axial displacement signal in consideration of a control constant in the frequency arithmetic unit.

6. (Original) A control method of a permanent-magnet type synchronous motor according to Claim 2, wherein:

the second step further includes a step for executing a first-order lag process.

7. (Original) A control method of a permanent-magnet type synchronous motor according to Claim 2, wherein:

the first step includes a step for operating a rotational phase signal of the motor based upon a polar position sensed signal of the motor and a step for operating the first axial displacement signal based upon deviation between the rotational phase direction and the rotational phase signal.

8. (Original) A control method of a permanent-magnet type synchronous motor according to Claim 2, wherein:

the first step includes a step for operating the first axial displacement signal based upon d-axis and q-axis output voltage directions, a sensed value of current flowing in the motor and the frequency direction.

9. (Original) A control method of a permanent-magnet type synchronous motor according to Claim 2, wherein:

the first step includes a step for operating current values of the d-axis and the q-axis based upon a sensed value of current flowing in the motor and the rotational phase direction and a step for operating the first axial displacement signal based upon the current values of the d-axis and the q-axis, the output voltage direction and the frequency direction.

10. (Original) A control method of a permanent-magnet type synchronous motor according to Claim 2, comprising:

a step for operating the rotational phase direction by differentiating the frequency direction.

11. (Currently amended) A control device of a permanent-magnet type synchronous motor provided with the permanent-magnet type synchronous motor, a frequency arithmetic unit that creates a frequency direction of alternating current fed to the motor based upon axial displacement in the motor for a rotational phase direction and a power converter that feeds alternating current of a variable frequency and variable voltage to the motor according to output voltage direction of a d-axis and a q-axis based upon the frequency direction and the rotational phase direction, comprising:

first axial displacement signal operating means for operating axial displacement which is difference between the rotational phase direction and a phase of a rotor of the motor using information acquired from a control system to be a first axial displacement signal;

second axial displacement signal estimating means for estimating axial displacement caused in the motor in relation to the frequency arithmetic unit as a second axial displacement signal; and

means for inputting a third axial displacement signal acquired by ~~tinging~~ adding the first and second axial displacement signals to the frequency arithmetic unit.

12. (Original) A control device of a permanent-magnet type synchronous motor according to Claim 11, wherein:

the second axial displacement signal estimating means is provided with means for inputting a signal related to a frequency or current acquired from a control system and estimating the second axial displacement signal using a control constant in the frequency arithmetic unit.

13. (Original) A control device of a permanent-magnet type synchronous motor according to Claim 11, wherein:

the second axial displacement signal estimating means is provided with means for differentiating a velocity frequency or a frequency direction calculated based upon a polar position sensed value of the motor, multiplying by a factor of proportionality, executing a first-order lag process and estimating the second axial displacement signal.

14. (Original) A control device of a permanent-magnet type synchronous motor according to Claim 11, wherein:

the second axial displacement signal estimating means is provided with means for inputting a current value or its directed value of a q-axis (equivalent to a torque axis) of a rotatory coordinate system calculated based upon a sensed value of

current flowing in the motor and the rotational phase direction and estimating the second axial displacement signal in consideration of a control constant in the frequency arithmetic unit.

15. (Original) A control device of a permanent-magnet type synchronous motor according to Claim 11, wherein:

the second axial displacement signal estimating means is further provided with first-order lag processing means.

16. (Original) A control device of a permanent-magnet type synchronous motor according to Claim 11, wherein:

the first axial displacement signal operating means is provided with means for operating a rotational phase signal of the motor based upon a polar position sensed signal of the motor and means for operating the first axial displacement signal based upon deviation between the rotational phase direction and the rotational phase signal.

17. (Original) A control device of a permanent-magnet type synchronous motor according to Claim 11, wherein:

the first axial displacement signal operating means is provided with means for operating the first axial displacement signal based upon the output voltage directions of the d-axis and the q-axis, a sensed value of current flowing in the motor and the frequency direction.

18. (Original) A control device of a permanent-magnet type synchronous motor according to Claim 11, wherein:

the first axial displacement signal operating means is provided with means for operating current values of the d-axis and the q-axis based upon a sensed value of current flowing in the motor and the rotational phase direction and means for operating the first axial displacement signal based upon the current values of the d-axis and the q-axis, the output voltage direction and the frequency direction.

19. (Original) A control device of a permanent-magnet type synchronous motor according to Claim 11, wherein:

the first axial displacement signal operating means is provided with a direct current sensor for sensing direct current flowing from a direct-current power supply to the power converter, current estimating means for estimating an each-phase current value of the motor based upon a direct current sensed value and means for operating current values of the d-axis and the q-axis based upon an each-phase current estimated value and the rotational phase direction.

20. (Original) A control device of a permanent-magnet type synchronous motor according to Claim 11, further comprising:

means for operating the rotational phase direction by differentiating the frequency direction.